NEWS REPORT

H. N. Gardner

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NEWS REPORT

National Academy of Sciences *National Research Council*

VOLUME VIII *May–June 1958* NUMBER 3

Preliminary Results of Satellites 1958 Alpha and 1958 Gamma

HUGH ODISHAW, *Executive Director*

United States National Committee, International Geophysical Year

PRELIMINARY reports on data gathered by United States IGY satellites 1958 Alpha and 1958 Gamma were made to members of the National Academy of Sciences, the American Physical Society, and the Washington scientific community at a special meeting held May 1, 1958, at the National Academy of Sciences.[1] The reports discussed high intensity radiation, micrometeorites, satellite temperatures, and atmospheric densities. Instrumentation for these experiments was carried aboard satellites launched by the Army and the Jet Propulsion Laboratory and popularly known as Explorers I and III.

Radiation Intensity

J. A. Van Allen, G. H. Ludwig, E. C. Ray, and C. E. McIlwain of the State University of Iowa, reported on radiation intensities measured by single Geiger tubes carried by 1958 Alpha and 1958 Gamma. At altitudes below about 1,000 kilometers, the cosmic ray counting rate agreed with extrapolations from similar data gathered on rocket flights. Above 1,100 kilometers, very high counting rates were obtained.

The very high rates (at least 35,000 counts per second if the Geiger tube had had zero dead time) were not observed directly but were deduced from the behavior of the Geiger tube. At times the Geiger tube indicated no counts. Van Allen and his associates concluded that this was not due to equipment malfunction but was caused by an intense radiation field, which blanked the Geiger tube.

By exposing a counting unit identical to that carried in 1958 Alpha to an X-ray beam, it was determined that at very high radiation fluxes the Geiger tube puts out pulses of such small height that they are below the threshold of the counting circuit. Thus the counting rate as registered by the counting circuit is zero. This happens when the radiation intensity reaches a value which should produce 35,000 counts a second from the Geiger tube.

An ion chamber placed in an X-ray beam generating the minimum flux needed to reduce the counting rate to zero measured an intensity of 60 milliroentgens per hour. The X-rays used had energies in the 50–90 kiloelectron volts (kev) range. Ionization produced by X-rays of different energies or by charged particles producing the same effect on the Geiger tube, would, of course, differ from this measurement.

[1] NATIONAL ACADEMY OF SCIENCES. IGY WORLD DATA CENTER A. ROCKETS AND SATELLITES. *Some preliminary reports of experiments in satellites 1958 alpha and 1958 gamma.* IGY Satellite Report Series No. 3, [100 pp.], illus. NAS-NRC, 1958.

The satellites carry no equipment which could determine the nature of the intense radiation, but it is presumed to be caused by either protons or electrons. If electrons, the radiation detected by the Geiger tube is probably X-rays produced by the collision of the electrons with the satellite shell.

The data analyzed came from both 1958 Alpha and 1958 Gamma. Although the counting rate in 1958 Alpha was transmitted continuously, the data were recorded only when the satellite was quite near one of the 16 receiving stations. The data collected by 1958 Gamma were also telemetered continuously and a small magnetic tape recorder stored the data obtained during each complete orbit. As the satellite passed near one of the receiving stations radio interrogation caused the data to be transmitted.

The interrogation signal activated a relay system which turned on the high-power transmitter and released the magnetic tape. Within five seconds the information was read off the tape, telemetered, and the tape erased. Upon completion of the cycle the relays were reset, the transmitter turned off, the tape rewound, and the next recording begun.

The data from 1958 Alpha were obtained mostly during the first two weeks in February. Data from 1958 Gamma were obtained during the last four days of March. Van Allen emphasized the preliminary nature of the report. The data analyzed represent only a portion of the total available data, which will be analyzed and reported on at a later date.

Van Allen [2] summarized the implications of the observations as follows:

> Any reasonable identification of this radiation strongly suggests several geophysical consequences. It is unlikely that the particles have several Bev of energy each. Then, in order to reach such small heights through the geomagnetic field, they must at least initially be associated with plasmas which seriously perturb the magnetic field at an earth radius or so. We presume that this plasma is closely related to geomagnetic storms and aurorae.
>
> Secondly, at heights only a little above 1000 km, there is still some atmosphere. Crude quantitative estimates suggest that the energy loss in this residual atmosphere at the radiation we detect may contribute significantly if not dominantly to the heating of the high atmosphere. In addition to considering this heating effect, it will be important to calculate, on various assumptions as to the nature of the radiation, the amount of visible light, radio noise, and ionization produced.
>
> Finally there are obvious biological implications of these results. * * * if photons are being detected directly by the geiger tube, and if these photons are in the energy range 50-90 kev, then the radiation field inside the satellite corresponds to about 0.06 roentgens/hr. The maximum permissible dose for human beings is 0.3 roentgens/week. Other assumptions as to the nature of the radiation would obviously lead to different results.

[2] *Ibid.*, pp. 89-90.

Optical Studies

G. F. Schilling reported on results from optical tracking of United States satellites, based on work done by himself and by Charles A. Whitney, Theodore E. Sterne and Luigi G. Jacchia at the Smithsonian Astrophysical Laboratory. Preliminary analysis of the data obtained by visual and precise photographic observations has supplied information on the spin of 1958 Alpha, on air density at very high altitudes, and on the expected lifetime of 1958 Alpha.

Charles A. Whitney found that 1958 Alpha, which was given a spin about its long axis during launching, now appears to rotate about its short axis, propellerlike. This conclusion is based on an observed variation of atmospheric drag.

Theodore E. Sterne has developed a simplified formula for computing the air density at very high altitudes from the motion of artificial satellites. This formula, applied to orbital data inferred by Whitney through a critical study of visual and radio observations of 1958 Alpha, gives an air density value of about 1.5×10^{-14} gm/cm^3 at an altitude of 368 kilometers. A cubic mile of air of this density would weigh only two ounces. Nevertheless, the density is about 14 times greater than that predicted in 1956 by R. A. Minzner and W. S. Ripley of the Air Force Cambridge Research Center.

Luigi G. Jacchia, using a formula developed by D. C. M. Leslie, estimates that 1958 Alpha will fall toward the end of 1962.

Orbital Determinations

Joseph W. Siry, of the Naval Research Laboratory, reported that the effect of at-

mospheric drag on the orbit of 1958 Alpha has been difficult to predict due to the fact that the drag force depends so strongly upon the angle of attack in the case of a slim cylinder such as 1958 Alpha. The orientation of the satellite as a function of time has been difficult to predict at times, thus making the prediction of the orbit correspondingly difficult. However, preliminary estimates by the Naval Research Laboratory indicate that the lifetime of 1958 Alpha will be about 5 to 10 years and that the atmospheric density in the neighborhood of perigee at about 370 kilometers is approximately 10^{-14} gm/cm^3.

Temperature Measurements

A. R. Hibbs and E. P. Buwalda, of the California Institute of Technology Jet Propulsion Laboratory, reported on a passive solution of space temperature problems and on temperature measurements made by 1958 Alpha. Inside the cylinder internal temperatures ranged from 0°C. to 35°C. and inside the nose cone from 5°C. to 40°C. Shell temperatures ranging from –25°C. to 75°C. were recorded.

The temperature control mechanism consists of a series of aluminum oxide strips covering approximately 25 percent of the outer surface of the instrument package. By both reflecting and re-radiating heat received by radiation from the sun and the earth, this coating was able to maintain interior temperatures well within the range needed to protect instrumentation from damage by heat or cold. The experiment was designed only to study the problem of instrument environment in a very small enclosure. However, it was noted that this technique provided temperatures in space within the range of human survival and that, with more elaborate techniques, the inner temperature of a larger space vehicle could be controlled within narrower limits.

Micrometeorite Densities

Dr. Edward Manring, of the Air Force Cambridge Research Center, reported on the determination of micrometeorite densities in the satellites' orbit by himself and Maurice Dubin.

Two micrometeorite detection systems are used. One, called the gauge detector, is carried on both 1958 Alpha and 1958 Gamma. The individual gauges are 1 square centimeter in area and are wound with two layers of enameled wire 17 microns in diameter. Twelve of these gauges, covering an area of two square inches, are mounted in circular pattern flush with the surface of the satellite's midsection. When a micrometeorite of 5 to 10 microns in diameter and travelling at meteor velocities, on the order of 25,000 miles per hour, smashes into one of the gauges, the continuous circuit breaks and changes the transmitted signal.

The second detector, flown only on 1958 Alpha, consists of a crystal microphone mounted against the skin of the satellite and connected to an amplifier. When the satellite is struck by a solid particle, the impact pressure is converted into an electrical signal which is transmitted to the monitor stations.

About 10 percent of the microphone data and 50 percent of the gauge data from 1958 Alpha are available for study. Seven hits have been detected by the microphone, but after 32 days of flight only one gauge had registered an impact. The data indicate that the average influx of particles 10 microns in diameter or greater was not more than 10^{-3}/m^2/sec during the period of observation, and that the average influx of particles four or more microns in diameter was about 10^{-2}/m^2/sec.

The above reports reflect preliminary results obtained from 1958 Alpha and, in the case of cosmic rays, from 1958 Gamma. Reports incorporating these preliminary results have now been sent to IGY World Data Centers and the Special Committee for the IGY. Analysis of the data from these satellites is continuing and will be the subject of further papers at an appropriate time.

There have been six satellites launched during the International Geophysical Year, three by the United States and three by the U.S.S.R.

1957 Alpha and 1957 Beta, the first U.S.S.R. satellites, have been described in the press and in the literature. 1958 Delta, the third U.S.S.R. satellite, was launched May 15, 1958, and the following descrip-

tion comes from a Moscow radio report. The satellite is conical in shape, 5 feet 8 inches wide at the base and 11 feet 9 inches long, and its shell is constructed of aluminum alloys. Its weight is 2,925 pounds, including 2,134 pounds for instruments for scientific research, radio measuring apparatus, and batteries. Measurements include pressure and composition of the atmosphere in the upper layers, concentration of positive ions, the magnitude of the electrical charge of the satellite, intensity of the earth's electrostatic field, intensity of the magnetic field of the earth, intensity of the sun's corpuscular radiation, cosmic radiation, micrometeors, and temperature inside and on the outside of the satellite. Early computations by the Naval Research Laboratory indicate that the initial perigee and apogee of 1958 Delta were 143 and 1,181 statute miles; the period of revolution was 106 minutes. The satellite entered its orbit inclined by 65° to the plane of the equator.

The preliminary results from United States satellites 1958 Alpha and 1958 Gamma have been reported above. 1958 Beta is a test sphere launched by the Naval Research Laboratory as part of the test phase of the Vanguard rocketry system. During the remainder of the United States-IGY satellite program, satellite launchings will take place at the rate of about one a month, carrying a variety of experiments selected by the U. S. National Committee for the IGY.

The Program of the Advisory Board on Education

R. M. WHALEY

Executive Director, Advisory Board on Education

IN THE two years since its first meeting on May 16, 1956, the Advisory Board on Education has endeavored to serve as a coordinating body for the educational interests of the various Divisions and Offices of the National Academy of Sciences–National Research Council. In addition, the Board has initiated or participated in educational programs wherein it was believed that the varied and wide scientific interest and experience represented throughout the Academy-Research Council could be particularly effective.

At a meeting of the Board on January 10, 1957, President Detlev W. Bronk spoke of the vital interdependence of education and research, emphasizing that the Advisory Board on Education must be the source and inspiration for a general broadening of the Academy's views and for comprehensive recommendations of action to be taken in the areas of the Academy's continuing responsibilities in education.

Active interest of the Academy in education extends back over four decades, for from 1919 to 1943 the National Research Council maintained a Division of Educational Relations. Since 1943 each of the Divisions and Offices has handled educational activities and policies in its own field; the Division of Biology and Agriculture and the Division of Mathematics have had special education committees for this purpose. The Committee on Educational Policies of the Division of Biology and Agriculture has had the active services of an Executive Secretary for the past three years, working on an extensive program which included studies on teacher education in biology as well as curriculum revision at both high school and college levels. The education committee of the

American Geological Institute has also produced career pamphlets and other educational materials for the earth sciences. More recently an Advisory Committee on Education has been established to develop plans for effective use of research results from the International Geophysical Year (IGY) in education at all levels. These and other educational programs of the Academy relating to curricula, teaching, and fellowships have been reported from time to time in NEWS REPORT.

To facilitate cooperation and coordination of such activities, each of the Divisions and the Office of Scientific Personnel is represented by one member on the Advisory Board on Education. The current members of the Board and the Division they represent are as follows:

MAYNARD M. BORING, Former consultant on manpower, General Electric Company, Engineering and Industrial Research, *Chairman*

FRANCIS BITTER, Massachusetts Institute of Technology, Physical Sciences

STEWART S. CAIRNS, University of Illinois, Mathematics

WARD DARLEY, Association of American Medical Colleges, Medical Sciences

THOMAS B. NOLAN, U. S. Geological Survey, Office of Scientific Personnel

HOWARD M. PHILLIPS, Alabama College, Biology and Agriculture

CHALMER J. ROY, Iowa State College, Earth Sciences

J. C. WARNER, Carnegie Institute of Technology, Chemistry and Chemical Technology

DAEL WOLFLE, American Association for the Advancement of Science, Anthropology and Psychology.

Former members were George R. Harrison, Massachusetts Institute of Technology, who was the first representative for the Division of Physical Sciences; and W. Barry Wood, Jr., Johns Hopkins University, representing the Division of Medical Sciences.

Since January 24, 1957, financial support from the Carnegie Corporation has made it possible to employ a full-time staff director and to expand activities of the Board further along the lines of the objectives adopted in the fall of 1956 (*see* NEWS REPORT, Vol. VII, No. 2, p. 24, 1957). Although most of the activities of the Board have multiple objectives, in general they may be classed in the following categories:

1) Assistance in the development of better community understanding and support of schools through local action programs.
2) Improvement in teaching—encouragement of more able people to select the profession as a career; enhancement of the status of the profession; improvement of teacher education, particularly in subject areas; and provision for opportunities for professional growth.
3) Improvement in the content of education—in the understanding of the educational process; in the curriculum; and in the development of criteria for the most effective planning, production, and use of aids such as films and television.

The Arlington Plan, initiated under the leadership of John S. Coleman, Executive Secretary of the Division of Physical Sciences, and subsequently continued under sponsorship of the Advisory Board, has now become self-perpetuating and an accepted part of the Arlington County, Va., program for its school teachers. This highly successful pilot operation, which developed community financial support and cooperation of universities in the area, enables teachers to take courses in the summer which will acquaint them with recent developments in their particular fields of interest and will provide credit toward advanced degrees. Arlington County is now extending the same opportunity to teachers in fields other than the sciences. Financial assistance from the Eugene and Agnes Meyer Foundation has made possible initiation of a comparable program in Montgomery County, Md.

Heartened by this beginning and recognizing that support at the community level is essential for the success of any program, the Board over the past two years has directed much of its interest toward aiding and encouraging the development of community programs wherein industrial and business leaders meet and work with educators for better education.

An example of such cooperative action was the Southern California Industry-Education Conference held July 7–13 at Lake Arrowhead, Calif. This conference was sponsored by the Academy–Research Council and the Hughes Aircraft Company in cooperation with the American Association for the Advancement of Science and the University of California at Los Angeles. Participants heard descriptions of

successful programs elsewhere and then discussed the special educational needs and resources of Southern California. Working group sessions which included representatives from industry, public schools, junior colleges, universities, and professional groups produced plans for a continuing action program. The Conference also created a new Southern California Industry-Education Council with representation from schools and industry in the area. Through a monthly *News Letter*, group meetings, and regular contacts by its Executive Secretary, the Council provides for continual exchange of ideas and information and maintains a coordinated program of industry-education activities, including the formation of four new county regional groups in the past few months. Progress for the year will be assessed at a follow-up conference, July 16–19, 1958, which will also be attended by representatives from other regions in California who are interested in the formation of similar councils in their areas.

Cooperation with other professional societies and organizations is one of the expressed objectives of the Board. It has thus worked with the President's Committee on Scientists and Engineers, through a Local Action Task Force, in an effort to help local communities improve their educational programs through activities designed to meet their particular needs. The Task Force has prepared and publicized a kit of descriptive material giving examples of effective community industry-education programs.

The Advisory Board on Education has been in communication with individuals and organizations in Texas, Pittsburgh, and the San Francisco Bay area where considerable interest is developing for such programs. The Board is also cooperating in planning for and will participate in the Fifth Annual Conference for the Advancement of Science and Mathematics Teaching in Texas, to be held in Austin, October 23–25, 1958. The conference this year will be regional and will include participants from several neighboring states.

Believing that the single most important need in education is an expanded corps of able and inspiring teachers, the Board is giving attention to improving teacher education, particularly to the need for improved opportunities for teachers to take courses in subject matter at the graduate level. By a resolution adopted on May 28, 1957, the Board recommended "that institutions of higher education establish programs of study leading to Master's degrees either in education or in the teaching of mathematics and/or science, such programs and the courses comprising them being especially designed with emphasis on subject matter to meet the needs of secondary school teachers."

Endorsement of the Advisory Board's resolution on graduate education for teachers has been secured from the Policy Committee for Mathematics, representing the following five organizations: American Mathematical Society, Association for Symbolic Logic, Institute of Mathematical Statistics, Mathematical Association of America, and National Council of Teachers of Mathematics. Resolutions similar to that of the Board have also been adopted by the American Association for the Advancement of Science, the American Chemical Society, the American Geological Institute, the American Institute of Biological Sciences, the American Institute of Physics, the Council on Graduate Work of the American Association of Land Grant Colleges and State Universities, and the Federation of American Societies for Experimental Biology.

Opportunity for a more general constructive approach to overcoming limitations in teacher education will be presented at a conference scheduled for June 24–28, 1958, at Bowling Green University, Bowling Green, Ohio. This is the annual conference of the National Commission on Teacher Education and Professional Standards. For the first time, the conference will be planned and carried out in cooperation with other societies. The cosponsoring groups are: The American Association for the Advancement of Science, the American Association of Colleges for Teacher Education, the American Council of Learned Societies, the Council on Cooperation in Teacher Education, the National Academy of Sciences–National Research Council, the National Association of State Directors

of Teacher Education and Certification, and the National Council for Accreditation of Teacher Education. About one-third of the expected thousand participants this year will be from academic departments in universities and colleges, representing both the sciences and the humanities.

At this conference of the National Commission on Teacher Education and Professional Standards, special attention will be given to the question of subject matter preparation of teachers. One of the principal objectives of the conference will be to establish procedures to include representatives from the humanities and the sciences on a regular basis in the planning of teacher education programs and certification requirements. The participants from each state will also meet in separate sessions to develop plans for follow-up action within their own state.

One of the first actions of the Advisory Board on Education was to sponsor a Conference on Educational Films and Television, held in New York City on July 19, 1956. This conference reflected early recognition by the Board that increasing use will be made of films and television in education. The Conference outlined several pressing problems, including the need for better evaluation of existing films and for the development of criteria relating to content and all phases of planning, production, and use of filmed and televised productions.

Instead of undertaking at once the formidable task of considering films in all fields of science, the Board decided first to explore existing films and kinescopes prepared for mathematics. Such a study was conducted by a Mathematics Film Evaluation Board, appointed through the Division of Mathematics. This Evaluation Board met last August at Pennsylvania State University and viewed 35 teaching films in mathematics, ranging from primary arithmetic through colleges courses. Many of the films were found to be inadequate and inaccurate, and recommendations for better planning and production of such presentations, including the active cooperation of professional mathematicians, have been incorporated in the published report "Films and Television in Mathematics Education" (NAS–NRC Publication 567).

A direct result of the recommendations in this report has been the appointment of a Committee on Mathematical Films and Television by the Division of Mathematics. The American Geological Institute has appointed a comparable committee for the earth sciences. The Advisory Board on Education will serve to coordinate the activities of these committees and will also provide for occasional interdisciplinary meetings with representatives of similar committees in other scientific societies which are also studying the educational uses of films and television.

To study the potential value of color television in education and to provide an opportunity for teachers of mathematics to increase their understanding of their own subject, the Board has cosponsored an experimental course in "Foundations of Analysis" taught by Professor R. A. Good of the University of Maryland and produced at the television studios of the Armed Forces Institute of Pathology, Walter Reed Army Medical Center. Other sponsors of the course have been the American Association for the Advancement of Science and the University of Maryland. The course consisted of twenty-six lectures given during the academic year 1957–58 on closed circuit color television for secondary school teachers of mathematics or science in the Washington area, some of whom took the course for graduate credit at the University of Maryland. The lectures are to be repeated, incorporating changes based on the participating students' experience, and will be recorded by color kinescope. Educators have expressed considerable interest in the use of kinescopes for in-service programs for teachers. Material covered includes much of the conceptual basis of modern mathematics recommended for new curricula in the secondary schools. Plans are being made for use of the kinescopes in other localities during the next academic year. An evaluation study of the course is being made.

The Advisory Board on Education is also cooperating with the Greater Washington Educational Television Association in its plans for presenting elementary science lessons for grades five and six by television

to classrooms in 13 cooperating schools in Virginia, Maryland, and the District of Columbia. Attention is being given to the relationship of elementary school science to junior high school science with the intent of developing an improved sequence of course materials for grades five through eight. A Science Advisory Committee is being appointed to assist in the determination of appropriate course content. Informal cooperation for planning the course content and adapting portions for television is under way with educators in the Pittsburgh area and with the staff of Pittsburgh's educational TV station WQED. The experience of scientists, educators, psychologists, and specialists who understand the medium will be used in planning the television lessons.

During the past winter, the Academy–Research Council and the American Association for the Advancement of Science have assisted in the selection of content for a series of four hour-long scientific television programs, produced by the Columbia Broadcasting System and sponsored by the Monsanto Chemical Company. The Advisory Board on Education solicited from the Divisions and their affiliated societies the names of outstanding scientists and suggestions of recent research or discoveries which might be noteworthy and newsworthy. Published accounts and public response indicate that the series, named "Conquest," represented a major step forward in the quality of science telecasting. The Academy's interest has been to present senior scientists and their work, feeling that science in its own right can be both exciting and entertaining.

The Advisory Board has discussed proposals for federal legislation on science and education as embodied in the two principal bills before the Congress. When Dr. Bronk appeared as the first witness to testify before the Senate Committee on Labor and Public Welfare, he referred to the objectives for such legislation outlined by the Advisory Board at its meeting on January 17 (*see* NEWS REPORT, Vol. VIII, No. 1, p. 17, 1958). Drs. Ralph E. Cleland, M. H. Trytten, and R. M. Whaley also appeared before this committee on February 24 with a statement which emphasized the increasing demand for more intellectual and technical skills in this country, especially in the sciences and foreign languages, and the urgent necessity for substantial financial support for educational programs which can provide such training.

At the meeting of the National Research Council on March 31, one of the major topics was "Education in Science." Dr. J. C. Warner, a member of the Advisory Board on Education, presided at this meeting, at which for the first time members of the Research Council discussed current educational problems. The meeting adopted a resolution to encourage more women to prepare for careers in science and to urge that employment policies restricting the employment of a husband and wife by the same institution be changed to take full advantage of our trained womanpower.

Attention is now being given to science curriculum studies and course developments, either planned or under way, to determine an appropriate course of action for the Academy–Research Council. Under discussion is the degree to which the Academy–Research Council should actively participate in such developments. Underlying all such questions of curriculum and course design are more basic ones dealing with the fundamental processes of education and with the psychological principles involved in learning and communication. Some concern has been expressed that relatively little direct attention is being given by research psychologists to educational procedures in the classroom. To explore possible relevance of basic research findings to education, and to indicate promising lines of research, a number of distinguished psychologists and educators were invited to a conference held at Easton, Md., on April 24–26, 1958. The conference developed constructive suggestions for action to raise the status of educational research and to encourage active participation by research psychologists in such programs.

The Advisory Board on Education will continue to direct its efforts toward effective use of the various Divisions and Offices of the Academy–Research Council in meeting broad problems of education that cut across disciplinary lines.

SCIENCE NEWS

ANNUAL MEETING NATIONAL ACADEMY OF SCIENCES

The ninety-fifth annual meeting of the National Academy of Sciences was held in Washington, April 28–30, with more than two hundred members in attendance. The program consisted of scientific sessions on Monday, April 28, and Wednesday, April 30; the presentation of Academy medals followed by scientific demonstrations and a reception on Monday evening, business sessions on Tuesday, April 29, and the annual dinner of the Academy on Tuesday evening, preceded by the President's reception.

In addition to a program of contributed papers, the scientific sessions featured four symposia of invited papers on widely diverse subjects. H. L. Shapiro of the American Museum of Natural History was chairman of the symposium on Science in Society on Monday morning. Dr. Shapiro's paper "Backgrounds and Beginnings" opened the symposium. I. Bernard Cohen of Harvard University spoke on "18th and 19th Century United States," Charles C. Gillispie of Princeton University on "Revolutionary France," and Chauncy D. Harris of the University of Chicago on "Contemporary Russia."

On Monday afternoon, a symposium on New Developments in the Study of Color Vision was held under the chairmanship of H. Keffer Hartline of the Rockefeller Institute. Speakers were C. H. Graham of Columbia University, E. H. Land of the Polaroid Corporation, Y. LeGrand of the National Museum of Natural History in Paris, W. A. H. Rushton of Cambridge University, and W. S. Stiles of the National Physical Laboratory, England. The papers dealt with color blindness, color vision in the natural image, theories of color vision, visual pigments in the human eye, and increment-threshold sensitivity.

The third symposium on Wednesday was devoted to age relationships of ancient rocks. Under the chairmanship of Alfred O. C. Nier of the University of Minnesota, seven papers were presented on the mineral ages of igneous rocks; ages of metamorphic rocks; ages of sedimentary rocks; the pre-Cambrian history of the Transvaal, South Africa; age relationships in North America; age relationships from lead isotope ratios; and ages of meteorites and the earth. The participants were as follows:

L. T. ALDRICH, Carnegie Institution of Washington
P. W. GAST, Columbia University
J. GEISS, University of Berne, Switzerland
L. O. NICOLAYSEN, University of the Witwatersrand, Johannesburg, South Africa
R. D. RUSSELL, University of Toronto, Canada
G. J. WASSERBURG, California Institute of Technology
G. W. WETHERILL, Carnegie Institution of Washington

C. H. Townes of Columbia University served as chairman of the fourth symposium on New Techniques in Microwave and Radiofrequency Physics on Wednesday afternoon. Following the introduction by Dr. Townes, R. H. Dicke of Princeton University spoke on "Optical Pumping and Atomic Clocks," N. Bloembergen of Harvard University on "Three-Level Masers," and G. Feher of Bell Telephone Laboratories on "Electron-Nuclear Double Resonance Experiments."

Sessions for contributed papers were held simultaneously with the four symposia. There were 31 papers, 23 of them by Academy members, covering the fields of astronomy, biochemistry, bacteriology, botany, chemistry, engineering, genetics, geology, geophysics, pathology, physiology, psychology, and zoology. Abstracts of the papers were printed in *Science*, Vol. 127, pp. 1058–1063, May 2, 1958.

Seven Academy medals and awards were presented in the Monday evening ceremony. Horace W. Babcock of Mount Wilson and Palomar Observatories received the Henry Draper Medal "for his original and outstanding work leading to the discovery of magnetic fields in stars and also the general magnetic field of the sun." The J. Lawrence Smith Medal was awarded to Mark G. Inghram of the University of Chicago for his work on the measurement of the ages of meteorites, and the James Craig Watson Medal was presented to George Van Biesbroeck, Emeritus Professor of As-

tronomy, Yerkes Observatory for his noteworthy contributions to astronomy.

The Charles Doolittle Walcott Medal was awarded to Pierre Hupé of the Laboratoire de Géologie de la Sorbonne, Université de Paris, in recognition of his monumental work entitled "Contribution à l'étude du Cambrien inférieur et du Précambrien III de l'antiatlas marocain." The Minister Plenipotentiary of France, Robert Valeur, accepted the medal on behalf of Dr. Hupé.

Gustav Arthur Cooper, Head Curator, Department of Geology, U. S. National Museum, was awarded the Mary Clark Thompson Medal for his contribution to our knowledge of the biology and stratigraphic significance of the fossil brachiopods. Ernest W. Goodpasture, Scientific Director, Department of Pathology, Armed Forces Institute of Pathology, received the Jessie Stevenson Kovalenko Medal for his outstanding contributions to medical science and for long and continued devotion to the study of his chosen field of pathology. The Kimber Genetics Award was presented to Theodosius Dobzhansky of Columbia University "as a versatile and inspired student of the mechanism of heredity, and of the roles which genetic and environmental factors play in the origin and structure of populations and in the process of biological evolution."

Edgar W. R. Steacie, President of the National Research Council of Canada and a Foreign Associate of the Academy, was guest of honor and addressed the members and their guests at the Academy dinner on Tuesday evening. Other honored guests at the dinner were James R. Killian, Jr., Special Assistant to the President for Science and Technology, who described some of the significant developments that had taken place in his office since its recent establishment; and P. W. Bridgman of Harvard University who was celebrating the 40th anniversary of his election to the Academy.

A specially honored guest was Henry Allen Moe, Secretary-General of the John Simon Guggenheim Memorial Foundation, who received the Public Welfare Medal at the dinner. This distinguished medal is unique among the Academy's medals in that it is awarded for eminence in the application of science to the public welfare rather than for achievements within a particular scientific discipline. Also, the award confers upon the recipient the right to be notified, like members, of the meetings of the Academy and invited to participate in its scientific sessions.

The election of officers and new members during the business session on Tuesday morning, April 29, is reported elsewhere in this issue of NEWS REPORT. The afternoon session on Tuesday was devoted to reports and discussions of the Academy's many activities at home and abroad and to broad questions of general concern to science and scientists.

While the members were meeting in business session, the lady guests of the Academy enjoyed a specially conducted tour of the Smithsonian Institution where they were able to visit the exhibit of Churchill paintings. After lunch at the Sulgrave club, the ladies viewed the collection of the Phillips Art Gallery, where the emphasis is on modern art.

ANNUAL MEETING
DIVISION OF CHEMISTRY AND CHEMICAL TECHNOLOGY

The annual meeting of the Division of Chemistry and Chemical Technology began with a dinner at the Hotel Washington on March 31. The evening's program was devoted to a discussion of international chemical and biochemical affairs, scientific affairs in the Department of State, and the handling of chemical literature.

Arthur C. Cope, Chairman of the U. S. National Committee for the International Union of Pure and Applied Chemistry (IUPAC), reported on the 19th Conference of the Union held at Paris in July 1957. Richard H. Barnes, Chairman of the U. S. National Committee for the International Union of Biochemistry (IUB), reviewed the history of the Union and spoke of plans for the Fourth Assembly in Vienna in September of this year. Wallace R. Brode, Science Adviser to the Secretary of State, outlined the science-related activities of the Department of State.

Robert E. Burk, Chairman of the Committee on Industrial Chemistry, discussed

the problem of the chemical industry resulting from the exponential increase in the volume of published chemical literature. He emphasized the importance of selecting a good coding system for chemical compounds and feasible methods for storing and retrieving information.

Division members assembled again on the following morning to receive the annual reports of the chairmen of the Divisional committees.

LECTURE BY SIR GEORGE THOMSON

Sir George Thomson, Master of Corpus Christi College of Cambridge University and the 1937 Nobel Laureate in Physics, presented the sixth lecture in the current Academy–Research Council series on Tuesday, April 8, on future sources of power. This was a fascinating account of the birth of a new source of power, the controlled thermonuclear reaction, which recently had been successfully achieved in Britain.

At present most of the world's power is produced from the fossil fuels, coal and oil; but in the foreseeable future these will be exhausted by a world in which the per capita expenditure of power is increasing at about 3 percent per annum. It is unlikely that solar radiation will supply the deficit in view of the large capital expenditures and repair costs for such installations. In Britian substantial and increasing use is being made of nuclear power derived from uranium; but by 1975, at least 40 percent of the electrical power generated will come from this source.

Although the energy available from the fission of uranium is enormous, the supplies are limited. The needs of the human race for power can be supplied best from the energy released in the fusion of two light nuclei. In practice the nuclei used will be either two of deuterium (heavy hydrogen) or one of deuterium and one of tritium (super-heavy hydrogen). There are indefinite amounts of deuterium available since it is a constituent to the extent of about 1/5,000th of the hydrogen in all water. A pound of heavy water costs about $30 and contains the energy equivalent of about 1,000 tons of coal.

The energy is the same as that which makes the H-bomb, but to release it in a controllable manner is a formidable problem. It implies the production and maintenance of extremely high temperatures, many millions of degrees, probably hotter even than the center of the sun. It is not too difficult to produce these temperatures but the problem is to maintain them. Recent work in Britain has accomplished this. In a device known as Zeta, which looks rather like a gigantic airplane tire made of aluminum, it has been possible to reach temperatures of 5 million degrees and show that fusion is actually taking place. Ionized deuterium circulates inside a torus and is prevented from touching the walls, and thereby losing its heat and destroying the walls, by means of a magnetic field. The yield of neutrons from the fusion reaction as a function of the temperature in Zeta was found to agree with the theoretical prediction, thus showing that a controlled thermonuclear reaction indeed had been achieved. The temperature was measured by the optical spectra of oxygen and nitrogen which were inside the torus.

Although the rate of fusion from a power point of view was infinitesimal, it seems that the rate can be increased comparatively easily. A hundredfold increase in temperature is needed before the problem is fully solved, but a tenfold increase might provide a useful device.

The economies will depend mainly on the capital cost of the installation which it is premature to attempt to predict. There is the possibility of extracting some of the energy directly as electricity with a consequent saving in efficiency and cost.

Nuclear power will probably not be used in small-scale installations because of harmful radiation, though in this respect fusion is somewhat better than fission since there is no radioactive "ash." The widespread use of nuclear power will affect the transportation industry, which now derives a considerable portion of its revenues from transporting fuels. Although power from fusion will not reduce the cost of electricity because the fuel is a small part of the total cost today, it will save mankind forever from anxiety about the supply of power.

ELECTION OF OFFICERS AND MEMBERS NATIONAL ACADEMY OF SCIENCES

At the annual business meeting of the Academy on April 29, Detlev W. Bronk, President of Rockefeller Institute, was elected to a third four-year term as President of the Academy, and Howard P. Robertson, Professor of Mathematical Physics at the California Institute of Technology, was elected Foreign Secretary for a four-year term also. Thomas F. Francis, Henry Sewall Professor of Epidemiology and Chairman of the Department, School of Public Health of the University of Michigan; and Saunders Mac Lane, Professor of Mathematics at the University of Chicago, were elected members of the Council of the Academy for three-year terms to succeed E. A. Doisy, St. Louis University School of Medicine, and Theophilus S. Painter, University of Texas, who will complete their terms on the Council on June 30, 1958.

The following new members and foreign associates were elected to the Academy:

New Members of the Academy

EMIL ARTIN, Henry B. Fine Professor of Mathematics, Princeton University

DIETRICH H. F. A. BODENSTEIN, Staff Member, Gerontology Branch, National Institutes of Health, Baltimore City Hospitals

DAVID BODIAN, Professor of Anatomy, Johns Hopkins School of Medicine

ANDRÉ FREDERIC COURNAND, Professor of Medicine, College of Physicians and Surgeons, Columbia University

MARTIN DEUTSCH, Professor of Physics, Massachusetts Institute of Technology

JOHN HOLMES DINGLE, Professor of Preventive Medicine, Western Reserve University

MARSHALL DEMOTTE GATES, JR., Professor of Chemistry, University of Rochester

WALTHER FREDERICK GOEBEL, Rockefeller Institute

LEO GOLDBERG, Director, the University Observatory, University of Michigan

MAURICE GOLDHABER, Senior Physicist, Brookhaven National Laboratory

WILLIAM ZEV HASSID, Professor of Plant Biochemistry, University of California at Berkeley

CHARLES ROY HAUSER, Professor of Chemistry, Duke University

ALFRED DAY HERSHEY, Staff Member, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.

ROBERT HOFSTADTER, Professor of Physics, Stanford University

IZAAK MAURITS KOLTHOFF, Professor of Analytical Chemistry, University of Minnesota

HENRY ARNOLD LARDY, Professor of Biochemistry, University of Wisconsin

ROBERT EUGENE MARSHAK, Harris Professor of Physics, University of Rochester

ROBERT RAYNOLDS MCMATH, Director, McMath-Hulburt Observatory, University of Michigan

ROBERT FRANKLIN MEHL, Dean of Graduate Studies, Carnegie Institute of Technology

NEAL ELGAR MILLER, Angell Professor of Psychology, Yale University

FRANK PRESS, Director, Seismological Laboratory, California Institute of Technology

ALFRED CLARENCE REDFIELD, Senior Oceanographer Emeritus, Woods Hole Oceanographic Institution

DICKINSON W. RICHARDS, JR., Lambert Professor of Medicine, College of Physicians and Surgeons, Columbia University

DAVID SHEMIN, Professor of Biochemistry, College of Physicians and Surgeons, Columbia University

THOMAS KILGORE SHERWOOD, Professor of Chemical Engineering, Massachusetts Institute of Technology

LLEWELLYN HILLETH THOMAS, Senior Staff Member, Watson Scientific Computing Laboratory, Columbia University

OSWALD GARRISON VILLARD, JR., Professor of Electrical Engineering, Stanford University

CHIEN-SHIUNG WU, Associate Professor of Physics, Columbia University

HATTEN SCHUYLER YODER, JR., Petrologist, Geophysical Laboratory, Carnegie Institution of Washington

BRUNO HASBROUCK ZIMM, Research Scientist, General Electric Company

Foreign Associates

PER ADOLF GEIJER, formerly Director, Geological Survey of Sweden, Stockholm, Sweden

HITOSHI KIHARA, Director, National Institute of Genetics, Misima, Japan

MAX VON LAUE, Director, Fritz Haber Institute of Max Planck Society, Berlin, Germany.

DIVISION OF MATHEMATICS ANNUAL MEETING

The annual meeting of the Division of Mathematics was held on Tuesday, April 1, with twenty-four members and guests in attendance. The major business of the half-day session was a discussion of current Division activities led by the Chairman, S. S. Wilks.

Dr. Wilks pointed out that the outstanding mathematical event of 1958 will be the International Congress of Mathematicians to be held in Edinburgh, Scotland, August 14–21. Through the efforts of the Division's Committee on Travel Grants, working in cooperation with the National Science Foundation, the Office of Naval

Research, the U. S. Army Office of Ordnance Research, and the U. S. Air Force Office of Scientific Research, travel support has been secured for more than sixty mathematicians. The Academy–Research Council will be represented at the General Assembly of the International Mathematical Union to be held at St. Andrews, Scotland, August 11–13, and at the subsequent International Congress by the following delegation:

MARSTON MORSE, Institute for Advanced Study, Princeton, N. J., *Chairman*
L. V. AHLFORS, Harvard University
A. A. ALBERT, University of Chicago
RICHARD BRAUER, Harvard University
RICHARD COURANT, New York University
J. L. DOOB, University of Illinois
NATHAN JACOBSON, Yale University
SAUNDERS MAC LANE, University of Chicago
DEANE MONTGOMERY, Institute for Advanced Study, Princeton, N. J.
S. S. WILKS, Princeton University

Other activities of the Division include the preparation of a pamphlet on mathematical careers for the use of high school students, plans to enlarge the circulation of *Mathematical Tables and Other Aids to Computation*, arrangements for a Conference on the Mathematics of Quantum Physics to be held in June, and the revision of the pamphlet "Passports, Visas, and Income Taxes" now being undertaken with the cooperation of the Office of International Relations.

In its business session the Division recommended that the Association for Computing Machinery be invited to nominate a representative to the Division for the period 1958–1961, thus joining the nine societies currently cooperating with the Division.

F. A. Ficken, chairman of the Committee on Regional Development, closed the meeting with a report on various proposals designed to encourage the expansion of mathematical research activity in the United States.

RESEARCH ASSOCIATESHIPS IN MATHEMATICS

The Office of Naval Research (ONR) has announced the award of nine postdoctoral research associateships in mathematics for the academic year 1958–59. As in the past these awards were made upon the recommendation of the Committee on Mathematics Advisory to ONR. The recipients of the research associateships are given below, together with the specific field of research and the institution making the appointment:

EDWARD F. ASSMUS, JR. (Ph.D., Harvard University, 1958)
Homological algebra—Columbia University
RICHARD E. BLOCK (Ph.D., University of Chicago, 1956)
Algebra—Yale University
MORTON BROWN (Ph.D., University of Wisconsin, 1958)
Point set topology—University of Michigan
HARRY H. CORSON (Ph.D., Duke University, 1957)
Topology—University of Washington
STEVEN A. GÁL (Ph.D., University of Budapest, 1947)
Analysis—Yale University
GEORGE KOLETTIS, JR. (Ph.D., University of Chicago, 1957)
Algebra—University of Notre Dame
BRUCE L. REINHART (Ph.D., Princeton University, 1956)
Differentiable manifolds—University of Michigan
KARL R. STROMBERG (Ph.D., University of Washington, 1958)
Abstract harmonic analysis—Yale University
ORLANDO E. VILLAMAYOR (Ph.D., University of Cordoba, 1946)
Algebra—Northwestern University

COMMITTEE ADVISORY TO THE OFFICE OF ORDNANCE RESEARCH

A joint meeting of the Committee Advisory to the Office of Ordnance Research (OOR), U. S. Army, and the Scientific Staff of OOR was held on May 2. Samuel S. Wilks, Chairman of the Division of Mathematics, who has been a member of the committee representing the sub-field of statistics and probability from 1953 to 1956, acted as temporary chairman for the meeting.

Col. George F. Leist explained in detail the organization and operation of OOR, and the Committee discussed current Academy–Research Council procedure for evaluating OOR research proposals. The Committee decided that its membership should be enlarged in order to cope with the augmented program and diversified sub-fields of each of the Divisions represented on the Committee. The increase in membership will be distributed between the four Divi-

sions as follows: Chemistry—8, Engineering—11, Mathematics—7, and Physics—7.

The following list shows the present membership of the Advisory Committee and the sub-fields represented, arranged by Division:

Division of Chemistry and Chemical Technology

ROBERT B. CARLIN, Carnegie Institute of Technology, Organic chemistry

PAUL C. CROSS, University of Washington, Physical chemistry

PAUL H. EMMETT, Johns Hopkins University, Physical chemistry

N. H. FURMAN, Princeton University, Analytical chemistry

A. W. LAUBENGAYER, Cornell University, Inorganic chemistry

H. F. MARK, Polytechnic Institute of Brooklyn, High polymers

CARL G. NIEMANN, California Institute of Technology, Organic chemistry

Division of Engineering and Industrial Research

CHARLES S. BARRETT, University of Chicago, Chemical engineering and metallurgy

DANIEL C. DRUCKER, Brown University, Mechanics

A. T. IPPEN, Massachusetts Institute of Technology, Fluid mechanics

F. A. MCCLINTOCK, Massachusetts Institute of Technology, Materials

E. F. OBERT, Northwestern University, Thermodynamics and Heat transfer

H. A. OHLGREN, University of Michigan, Chemical engineering and metallurgy

JOHN D. RYDER, Michigan State University, Electrical engineering and acoustics

Division of Mathematics

LARS V. AHLFORS, Harvard University, Analysis

A. A. ALBERT, University of Chicago, Algebra, Theory of numbers and foundations

T. W. ANDERSON, Center for Advanced Study in the Behavioral Sciences, Stanford University, Statistics and probability

M. R. HESTENES, University of California at Los Angeles, Applied mathematics and numerical analysis

NATHAN JACOBSON, Yale University, Algebra, Theory of numbers and foundations

ROBERT F. RINEHART, Case Institute of Technology, Operations research

N. E. STEENROD, Princeton University, Topology and geometry

Division of Physical Sciences

BRYCE L. CRAWFORD, University of Minnesota, Chemical physics

B. P. DAILEY, Columbia University, Microwaves

BERNARD T. FELD, Massachusetts Institute of Technology, Nuclear physics

DEANE B. JUDD, National Bureau of Standards, Optics and other miscellaneous fields

ROBERT L. SPROULL, Cornell University, Solid state physics

JOINT MEETING OF RADIO SCIENTISTS AND RADIO ENGINEERS

The semi-annual scientific meeting, jointly sponsored by the U. S. National Committee of the International Scientific Radio Union (URSI) and the Institute of Radio Engineers, April 24–26, was the largest in recent years. During the scientific sessions, 161 men presented 124 papers on various phases of radio research before the 640 registrants.

At the luncheon meeting on Friday, April 25, Wallace R. Brode, Science Adviser to the Secretary of State, outlined the status of international scientific organizations and some of the problems involved in promoting the exchange of research information across national borders. The work of international organizations such as URSI, he felt, was a powerful factor in effecting international understanding and good will.

In conjunction with the joint meeting, the U. S. National Committee of URSI and its seven Commissions held business meetings at the National Bureau of Standards. The Committee decided to make its report to the Academy–Research Council on the 12th General Assembly of URSI held at Boulder, Colo., last summer available to the general scientific public by publishing it as part of the regular NAS-NRC series (*see* New Publications, p. 59).

At the business meeting W. E. Gordon, School of Electrical Engineering at Cornell University, was elected *Chairman* of the U. S. National Committee; John P. Hagen, Naval Research Laboratory, *Vice-Chairman;* S. Silver, Electronics Research Laboratory at the University of California at Berkeley, *Secretary;* and A. H. Waynick, Department of Electrical Engineering, Pennsylvania State University, *Treasurer.* Each of these officers will serve until June 30, 1960, following the next General Assembly of URSI. M. G. Morgan of the Thayer School of Engineering, Dartmouth College, was named Associate Editor of the *URSI Information Bulletin* representing the United States.

At the business sessions of the seven commissions under the U. S. National Committee, the following Commission and Subcommission Chairmen took office:

Commission 1—Radio Measurement Methods and Standards
R. W. BEATTY, National Bureau of Standards, Boulder Laboratories

Commission 2—Tropospheric Radio Propagation
I. H. GERKS, Collins Radio Company

Commission 3—Ionospheric Radio Propagation
LAURENCE A. MANNING, Electronics Research Laboratory, Stanford University

Commission 4—Radio Noise of Terrestrial Origin
WM. Q. CRICHLOW, National Bureau of Standards, Boulder Laboratories

Commission 5—Radio Astronomy
E. F. MCCLAIN, Naval Research Laboratory

Commission 6—Radio Waves and Circuits
JOHN I. BOHNERT, Naval Research Laboratory

Subcommission 6.1—Information Theory, and Subcommission 6.2—Circuit Theory
LOFTI ZADEH, Columbia University

Subcommission 6.3—Antennas and Waveguides
JOHN I. BOHNERT, Naval Research Laboratory

Commission 7—Radio Electronics
MARVIN CHODOROW, Microwave Laboratory, Stanford University

At the meeting of the U. S. National Committee on Wednesday, April 23, Lloyd V. Berkner, President of URSI and also of the International Council of Scientific Unions, reported on the activities of the international officers of the Union. They have proposed new rules for the operation of the International Commissions and for securing and handling technical contributions to the General Assemblies. These proposals are now before the various national committees for comment. Plans are also being made to expedite and improve the flow of work between General Assemblies of the Union.

The fall meeting of the U. S. National Committee of URSI will be held, October 20–22, at Pennsylvania State University.

MOHO CONFERENCE

On April 26, the Special Moho Committee of the American Miscellaneous Society (now known as the AMSOC Committee) held a conference to consider the scientific objectives of drilling a hole to the Mohorovičić (M) discontinuity and to discuss the technological feasibility of such deep drilling. The National Science Foundation has approved a request for $30,000 to finance the first stages of the operation. The M discontinuity is that between the Earth's crust and the mantle and is found at an average depth of about 35 km. under the continents but may be as close as 4 km. under the sea floor. There is probably no project within the scope of present capabilities which would provide more information concerning the broad picture of the Earth as a planet than drilling a hole through the sediments and the so-called basalt layer and finally into the upper mantle. It is looked upon as a courageous attempt to broaden the base on which some of the most fundamental of the Earth's problems rests.

The Committee pointed out that if it were possible to obtain authentic samples of the material below the discontinuity, speculation could be replaced by facts concerning *a*) density; *b*) composition, and bulk and mineral phases; *c*) radioactivity; *d*) age; and *e*) isotopic composition. The over-all properties of materials through which the drill hole would pass could be measured to great advantage. For example, figures could be obtained on the temperature gradient and conductivity, and from these could be obtained a better understanding of heat flow. A seismic velocity log could contribute to better understanding of the results of seismic research at sea, and perhaps other tests might be made for seismic anisotropy in different directions around the hole. The magnetic properties of the materials in the hole could be determined, and various types of electric logging could be done coupled with laboratory measurements of the samples.

The Committee enumerated the obvious objectives connected with the drilling but pointed out that undoubtedly in probing into new and unexplored territory, the unexpected discoveries might play a large role in the final value of the work. At present, the discussion is limited to a site of drilling in the deep sea. Some months ago it seemed possible that a site on an atoll might be equally fruitful but this seems much less likely since Raitt's seismic profiles around Eniwetok have appeared. Such a site always had the disadvantage of drilling through the underpinnings of a volcano, but it now has the additional disadvantage of being considerably deeper to the M discontinuity than had been supposed, being well in excess of the 30,000 feet of the older estimate.

COMMITTEE ON MATHEMATICAL FILMS AND TELEVISION

The Committee on Mathematical Films and Television held its first meeting on Saturday, May 17, in the Academy–Research Council building. This committee was established in accordance with the recommendations of the final report of the Film Evaluation Board with the following membership:

C. B. Allendoerfer, University of Washington, *Chairman*
R. A. Good, University of Maryland
G. A. Hedlund, Yale University
P. S. Jones, University of Michigan
E. J. McShane, University of Virginia
J. R. Mayor, American Association for the Advancement of Science
P. C. Rosenbloom, University of Minnesota

Dr. Hedlund presided in the absence of the chairman.

At this first meeting the Committee adopted the following objectives based on the recommendations of the Film Evaluation Board: *a*) to consider procedures needed to collect and disseminate trustworthy information on mathematical films, *b*) to improve techniques for evaluating mathematical films and television presentations, *c*) to encourage mathematicians to participate in planning, refereeing, and presenting such programs, *d*) to assist in developing equitable economic policies for participants in a presentation, and *e*) to provide liaison with the mathematical community and other professional groups. Through the Advisory Board on Education funds will be solicited to finance the committee's operation and to provide desired cooperation with representatives of similar committees within and without the Academy, and with representatives of various curriculum study groups.

The following guests attended the first meeting and participated in the discussions:

E. G. Begle, Director, School Mathematics Study Group, Yale University
C. J. McIntyre, Chief, Instructional Procedures and Evaluation Branch, Office of Armed Forces Information and Education
W. C. Michels, Physical Science Study Steering Committee
R. M. Whaley, Advisory Board on Education
S. S. Wilks, Chairman of the Division of Mathematics

ANNUAL MEETING DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH

The Division of Engineering and Industrial Research held its annual meeting on April 1 in conjunction with the National Research Council meeting, March 30–April 1. In the absence of Division Chairman, E. C. Bain, who was en route to Japan, Vice Adm. E. L. Cochrane, U. S. Navy (ret.), acted as Chairman.

At the business session, the Division elected the following persons to serve as members of the Executive Committee for a one-year term:

Edmond Claxton, Armstrong Cork Company
E. L. Cochrane, Massachusetts Institute of Technology
Paul D. Foote, Assistant Secretary of Defense for Research and Engineering
Richard C. Jordan, University of Minnesota
A. T. McPherson, National Bureau of Standards
H. S. Osborne, American Telephone and Telegraph Company (ret.)
K. B. Woods, Purdue University

Brief reports were presented by the major committees and boards of the Division with special emphasis on the San Francisco Port Study of the Maritime Cargo Transportation Conference and on the organization and activities of the newly established U. S. National Committee for the International Institute of Refrigeration.

LECTURE BY THORBJÖRN O. CASPERSSON

The fifth lecture in the Academy–Research Council series was presented on Tuesday afternoon, February 25, by Torbjörn O. Caspersson, Professor of Medical Cell Research and Genetics at the Royal Caroline Medico-Surgical Institute in Stockholm, who spoke on "The Study of Cell Growth by Quantitative Cytochemical Procedures."

This well-illustrated lecture was concerned with the chemical characteristics of living plant and animal cells as revealed by optical cytochemical techniques. Elaborate and complicated instrumentation has been developed to perform these analyses rapidly and accurately. Dr. Caspersson pointed out that the original limitations of ultramicrospectography were overcome by incorporating automatic scanning and computing devices within the instrumentation.

Now, by measuring thousands of points in each cell, data representative for entire cell populations can be obtained within a reasonable time. Earlier, these problems were not within reach of cytochemical methods because long working periods were needed, during which the cells died.

Automation made it possible to coordinate several instruments using various parts of the spectrum so that different analytical techniques can rapidly be applied in sequence to the same living cellular object.

Recently, Dr. Caspersson's studies have shown that among advanced tumor cell populations not only are there tremendous variations in composition, but also that the nature of this variation changes under the influence of such factors as chemotherapy and radiation.

In many cases parts of the cells die and other parts are selected out to thrive under the new conditions. For instance, in an experimental *ascites* tumor under the influence of amethopterine, a special cell line is selected out, quite different from the original one. This demonstrates that the cytochemical analysis of tumor cell populations provides a way to study the mechanism of tumor progression, a phenomenon which underlies sudden changes in growth rate, reaction to chemotherapy, and so forth.

For the study of carcinogenesis the possibility of cytochemical population studies seems to be of value. Already, the limited studies made so far have revealed that these very great variances from normal cell populations exist even at early stages of tumor development. Further work may yield deeper understanding of the factors influencing tumor development and provide a diagnostic aid in the cytochemical identification of the very early stages of tumor growth.

PETROLEUM RESEARCH FELLOWSHIP AWARDS

Two Petroleum Research Fund postdoctoral fellowships have been awarded for 1958–59. These fellowships, sponsored by the American Chemical Society and administered by the Academy–Research Council, were inaugurated in 1954 by the Society to provide advanced scientific education and fundamental research in the petroleum field. The recipients are listed below:

ALBERT J. MOSCOWITZ (Ph.D., Harvard University, 1957)
Application of the techniques of electron spin resonance to the solution of chemical problems —Washington University, with S. I. Weismann (renewal)

JOHN K. OSMOND (Ph.D., University of Wisconsin, 1954)
Research on radioactive measurements of sedimentary rocks—Rice Institute, with J. A. S. Adams

STAFF APPOINTMENTS

The Division of Medical Sciences announces the appointment of **Robert I. McClaughry** as Professional Associate effective June 1. He will be attached to the office of the Chairman. Dr. McClaughry received his M. D. and M. S. degrees in physiology and pharmacology from Wayne State University. Since 1953 he has been Assistant Professor of Physiology and Pharmacology at Wayne State University Medical School, where he also served as Assistant Dean for two years, prior to his appointment as Director of Medical Education and Attending Physician at Providence Hospital in Detroit. Much of his research experience has been in the field of blood coagulation.

Orlando Carbia has been appointed a Professional Assistant in the Institute of Laboratory Animal Resources effective June 1. Mr. Carbia received his A.B. degree in animal husbandry from the University of Maryland and has served as the Supervisor of the Animal Colonies at the Armed Forces Institute of Pathology for the past three years.

The Building Research Institute has announced the appointment of **Herbert L. Triedman** to handle publicity and public relations. Mr. Triedman is a graduate of Harvard University and prior to coming to the Academy–Research Council did public relations work for the Military District of Washington while in the service.

Concurrent with Mr. Triedman's appointment, **Mrs. Jean Houtchens,** formerly associate editor for the Building Research Institute, was appointed Manager of Information Services.

RECORD OF MEETINGS

March	
3	Federal Construction Council, Task Group on Air-Conditioning Design
	Subcommittee on the Cardiovascular System
	Sub-panel on Rolling of Titanium
4–5	Sub-panel on Evaluation of Titanium
5	Committee on International Anthropology, *Stanford, Calif.*
5–6	Conference on Plastics in Building Illumination, *Houston*
6	Committee on Urban Research, Steering Committee
	Sub-panel on Heat Treatment of Titanium
6–7	Committee on Ship Steel
7	Federal Construction Council, Task Group on Underground Heat Distribution Systems
	Sub-panel on Titanium Alloy Selection
8	National Research Council Postdoctoral Fellowship Board
10	Committee on Cartography Advisory to the Department of State
	Committee on a National Atlas
11	Committee on Dietary Allowances
	Titanium Process Review Committee
11–12	Federal Housing Administration Advisory Committee on Technical Studies
12	Subcommittee on the Skeletal System
13	Committee on Prosthetics Education and Information
14	Committee on Ship Steel, Project Advisory Committee SR-124
15–16	Division of Biology and Agriculture, Committee on Educational Policies
17	Institute of Laboratory Animal Resources, Governing Board
17–18	Panel on Beryllium
18	Advisory Board on Education
	Air Materiel Command Panel on Manufacturing Processes
	Committee on Symbols, Units, and Nomenclature, *New York City*
	Institute of Laboratory Animal Resources, Standards Committee
19	Committee on International Exchange of Persons
20	Advisory Committee on Civil Defense
	Committee on Physical Anthropology
21	Committee on Ship Steel, Project Advisory Committee SR-128

March	
21	Conference on Electrical Insulation, Executive Committee
	Panel on New Devices for Exploring the Ocean
21–22	Committee on Child Development
22–23	USA National Committee, International Union Against Cancer
22–24	Committee on Oceanography, *Miami, Fla.*
24	Panel on Ocean Resources, *New York City*
24–25	Committee on Climatology, *Columbia, Mo.*
25	Subcommittee on Animal Products, *Chicago*
26–27	Study Group on Disposal of Low Level Radioactive Wastes, *Woods Hole, Mass.*
27	Food and Nutrition Board, Executive Committee
	Committee on Amino Acids
	Committee on Protein Malnutrition
	Committee on Dietary Allowances
	Subcommittee on Food Technology
28	International Congress on Nutrition, Women's Committee
	Sub-panel on Steel Rolling Techniques
28–29	Food and Nutrition Board
	Subcommittee on Research Reactors, *Ann Arbor*
30	Committee on Drug Addiction and Narcotics
	Division of Chemistry and Chemical Technology, Executive Committee
30–31	Division of Physical Sciences, Annual Meeting
30–April 1	National Research Council
31	Panel on Toxicity of Beryllium
	Division of Chemistry and Chemical Technology, Annual Meeting
	Division of Mathematics, Executive Committee
	Maintenance Advisory Panel for AASHO Road Test, *Chicago*
31–April 1	Armed Forces–National Research Council Committee on Vision
April	
1	Division of Biology and Agriculture, Annual Meeting
	Division of Earth Sciences, Annual Meeting
	Division of Engineering and Industrial Research, Annual Meeting
	Division of Mathematics, Annual Meeting
	Division of Medical Sciences, Annual Meeting

April		April	
2	Armed Forces–National Research Council Committee on Vision, Executive Committee	21	Panel on Oceanographic Research Ships
	Rocket and Satellite Research Panel	21–23	Building Research Institute, Annual Meeting
2–3	Advisory Committee on the National Bureau of Standards for Radio Engineering, *Boulder, Colo.*	22	Ad hoc Study Committe on Physical Sciences
3	Subcommittee on Radiation Preservation, *Lemont, Ill.*		Study Group on Perspectives in Metallurgy
	Committee on Urban Research, Planning Committee	23	Highway Research Board, Department Chairmen
3–4	Panel on Thermal Protection Systems		Building Research Advisory Board, Executive Committee
4	Committee on Pathology		USA National Committee, International Scientific Radio Union
5	USA National Committee, International Union Against Cancer	24	Building Research Advisory Board Industry Meeting on Federal Housing Administration Proposals
9	Subcommittee on Cereal and Baked Products, *Cincinnati*		Materials Advisory Board
	Ad hoc Inter-Society Committee on Pathology		Committee on Textile Fabrics, *New York City*
10	Committee on Agricultural Equipment	25	Maritime Cargo Transportation Conference, Port Study Committee, Industry Advisory Committee, and Academic Advisory Committee, *San Francisco*
12	USA National Committee, International Union of Biochemistry		Advisory Committee to the National Bureau of Standards for Metallurgy
14	Subcommittee on Neutron Measurements and Standards, *Ann Arbor*		USA National Committee, International Scientific Radio Union
	Panel on Blood Coagulation, *Philadelphia*	25–26	Agricultural Board
14–15	Committee on Polar Research	26	Special Mohorovičić Committee of the American Miscellaneous Society
15	Subcommittee on Dairy, Oil, and Fat Products, *Chicago*	26–27	Committee on Oceanography
16	Subcommittee on Toxicology, *Philadelphia*	27	National Academy of Sciences–National Research Council, Governing Board
	Committee on Biological Chemistry, *Philadelphia*	28	Prosthetics Research Board
	Advisory Committee for the Cardiovascular Literature Project, *Philadelphia*	28–30	National Academy of Sciences, Annual Meeting
17	Committee on Nutrition Studies at Elgin State Hospital, *Philadelphia*	29	Subcommittee on Rigid Pavement Design
	National Advisory Committee for AASHO Road Test, *La Salle, Ill.*		Institute of Laboratory Animal Resources, Executive Committee
17–18	Sub-panel on Titanium Alloy Selection		Rigid Pavement Design Committee, Subcommittee on Continuous Steel Reinforcement
21	Committee on Urban Research, Planning Committee	30	Federal Construction Council Task Group on Catholic Protection as Applied to Underground Structures
	National Committee on Extra-Atmospheric Cosmic Ray Research		

NEW PUBLICATIONS

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Notice of Academy Meeting

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Autumn Meeting, University of California at Berkeley, November 6–8, 1958

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